DIVISION OF ENTOMOLOGY

BULLETIN No. 1
PART 4

REPORT OF WORK
OF THE
EXPERIMENT STATION
OF THE
HAWAIIAN SUGAR PLANTERS' ASSOCIATION

Leaf-Hoppers and their Natural Enemies

(PT. IV. PIPUNCULIDÆ)

BY R. C. L. PERKINS

HONOLULU, H. T.
SEPTEMBER, 1905

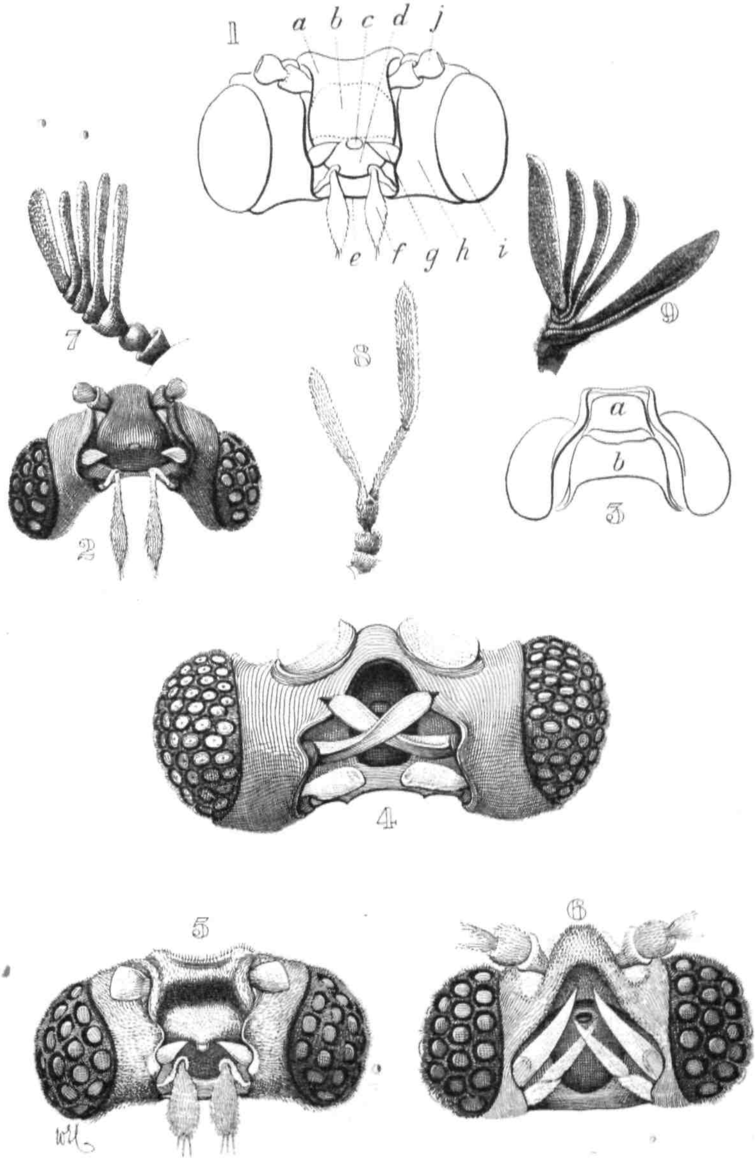

PLATE I.

LETTER OF TRANSMITTAL.

To Special Committee on Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, T. H.

Gentlemen:—I herewith submit for publication Part IV of Bulletin I. This deals with the two-winged flies parasitic on leaf-hoppers, thirty-four species of these parasites being here enumerated, and thirty-one of these described as new.

Yours obediently,

R. C. L. PERKINS,
Director, Division of Entomology.

Honolulu, T. H., August 11th, 1905.

GENERAL REMARKS ON THE PIPUNCULIDAE.

The Pipunculidae are a very distinct family of small and obscure flies, which in their habits, so far as these are known, all agree in the fact that they are parasites of the Homopterous Rhynchota. There are but few genera in this family, the great majority of the species being referred to the genus *Pipunculus*, as are all the new species described in this paper.

Verrall in his "British Flies" (Syrphidae, etc.) published in 1901 gives the known species of *Pipunculus* as nearly 50 European, about 8 North American, 1 Brazilian, 8 South African, 6 Central American, and 2 Chinese. He also mentions New Guinea as a habitat. About the same time three new species were described by Grimshaw from the Hawaiian Islands, making a total of about 80 species for the genus. It is probable that at the most not more than one in ten existing species has been collected, for while the genus appears to be ubiquitous in distribution, its members are too unattractive in appearance and too fragile to have been much sought after in the tropics, and further I am quite satisfied that many of the species will not be easily obtained except by breeding them. The latter statement applies particularly to some species that attack arboreal leaf-hoppers.

As a matter of fact it appears that extremely few of the many known species have been bred, or at least of very few has the fact been recorded. Of the 26 species found by us in Australia, 15 were bred from the leaf-hoppers themselves, and one from collected pupae, the host being unknown to us.

Inconspicuous as the flies are when seen in a collection, even more so are they in life, for when on the wing most of them appear even smaller than they really are. Some of the Australian species under favorable circumstances occur in prodigious numbers. In the dry bed of a stream near Cairns at the end of August there were small patches of green grass at intervals, when the surrounding country was dried up. On these patches of grass large flocks of various small Jassid and Fulgorid leaf-hoppers were feeding, and, in search of the former, countless numbers of a species of *Pipunculus* (*P. beneficiens*) were passing

from patch to patch in endless procession, threading their way amongst the grass stems. At any time an insect net could be thrown over half a dozen specimens at once, as they moved along. In similar abundance Mr. Koebele found the same species on some sandhills near Bundaberg, on an occasion when I was not with him. Many of the grass-loving species fly very low and irregularly amongst the grass, as if making a close scrutiny on all sides as they pass along.

On another occasion in a wood at Bundaberg, where a species of *Siphanta* was breeding in large numbers on *Ficus* and other trees, *P. helluo* was literally swarming, buzzing round every twig, even in the deep shade of the trees. The nymphs of this *Siphanta* are always concealed beneath the leaves, feeding on the under surface, and when making particular scrutiny of these, the fly would be seen to hover and poise itself like an ordinary Syrphid, giving up its usual, more erratic and irregular flight. The latter was quite similar to that of a hymenopterous parasite of the genus *Chalcis*, which, seeking caterpillars on the same trees at the same time, was as common as the fly; in fact these two very different parasites were not very easily distinguishable when on the wing. Owing to the position of the nymphs of the *Siphanta* I was not able to see the fly actually sting these, but several times one was observed to make a dart beneath a leaf, where the young leaf-hoppers congregated. By collecting some of these nymphs, the *Pipunculus* was easily bred in confinement. Dr. F. Jenkinson of Cambridge in 1903 published an account of the attack of *Verrallia*, a genus allied to *Pipunculus*, on frog-hoppers (Ent. Monthly Mag. XXXIX (1903) p. 222) and I herewith give in full this interesting note:

"I suppose the oviposition of *Pipunculidae* has been recorded somewhere, but I have not seen it described; although the form of the ovipositor and the strong legs and claws (sometimes at least larger in the female) enable us to guess what must take place. Noting *V. aucta* to be common in my garden on the morning of July 5th, I determined to watch them as they busily beat over every inch of the herbage. I sometimes had four in view at one time. Frog-hoppers being as scarce as *Verrallia* was common (perhaps these facts are not entirely unconnected with each other), I occasionally caught one and put it in the *Verrallia's* path, with complete success. As soon as a *Verrallia* saw a frog-hopper it poised itself in the air (like a kestrel hovering, but with a certain intensity perceptible in its motionless-

ness), and if the position of its victim was favourable, it pounced upon it immediately. Then the frog-hopper hopped; in some cases the fly lost it; in some cases the fly reappeared instantly from the place to which the frog-hopper hopped. In one case I saw the frog-hopper land with the fly still on its back ; I caught both, without waiting, as perhaps I should have done. If the position was unfavourable, or stems got in the way (e. g. *Geranium Robertianum*), the fly would circle round with its head towards the victim, like a male *Dolichopus*, seeking a point from which to pounce. On several occasions it failed to get a hold. Once a fly pounced on a frog-hopper *which did not hop*; the fly immediately left it. Another came up and looked at it, but went away without touching it. Was the frog-happer already entertaining an egg, or was it a male, or for some reason unsuitable? *Chalarus* is common in my garden, but I have not been able to see anything of its oviposition.

"These observations are crude and inconclusive on several points; but I send them on the chance that others who can afford the time will complete them. The flies are still common, and the frog-hoppers now less scarce."

Verrall remarks that he considers the Pipunculidae to be the most exquisite fliers that exist in Diptera. However true this may be of the European, I do not think it can be said of the Australian or Hawaiian species, which cannot compare in power and beauty of flight with many Syrphidae or other flies; indeed to cite but one instance they are vastly inferior to the Australian species of *Baccha* in this respect. It is certain however, that on capture they often exhibit to the full their power of hovering within the meshes of the net, where more sturdy species, which while free can remain poised and motionless in the air or dart forward with speed that baffles the vision, would under like circumstances beat wildly against the sides in their endeavour to escape.

The Pipunculidae are known to affect various families of Homoptera, the spittle-insects or Cercopidae, as well as the Jassidae and Fulgoridae, and perhaps the Cicadidae, being subject to their attacks. It is not known whether in any case the same species of parasite will attack leaf-hoppers of more than one family, e. g. Fulgoridae and Jassidae. In this connection, however, one may mention the fact that the resemblance between such species as *P. helluo* and *P. Koebelei* is extreme, both structurally and superficially, although the former is parasitic

on *Siphanta* and the latter on a Jassid somewhat allied to *Penthimia*. The fact that the two flies are so extremely similar while the hosts are so utterly unlike leads me to suspect that species of Pipunculus may be found that attack species of either family of leaf-hoppers indiscriminately. However this may be, it is certain that some of these flies will attack very different species of leaf-hoppers within the limits of a family. For example that most common Australian species *P. beneficiens* was bred from nymphs of three or four very different Jassids, and *P. cruciator* from two widely different genera, of the same family. It may also be noted that nymphs and adult leaf-hoppers are both subject to attack.

In Australia all the species of *Pipunculus*, that we bred, were from Jassidae, excepting two, one of which (*P. helluo*) is a parasite, as above mentioned, on *Siphanta* and allied genera, while the other (*P. xanthocnemis*) attacks a species of *Liburnia*. The Hawaiian species here described are probably all attached to Delphacine Fulgorids. Three of the five most certainly are, since one of the latter has been bred by Mr. O. H. Swezey, and the other two are found in company with the same leaf-hoppers, in places where Jassids are quite absent.

There is, so far as I know, no means of telling with absolute certainly whether a living leaf-hopper contains a larva of *Pipunculus* or not. In some species of a green colour, when the parasitic larva becomes large, the green of the hopper is not infrequently changed to a sickly yellow, or even dark discoloration may be seen, but in most cases a slight sickly appearance, evidenced by indescribably minute differences in its superficial appearance, or by its more lethargic movements, alone inform one, or at least lead one to suspect, that the leaf-hopper is parasitized. Practically it is not difficult to detect parasitized individuals, when one is familiar with the species of leaf-hopper that is infested. If a green Jassid containing a large *Pipunculus* larva be placed in alcohol, so that the colouring matter is largely removed, and greater transparency is attained, it is sometimes possible to see the parasitic larva quite plainly through the cuticle of its host. The head of the larva appears to be always turned towards the head of the leaf-hopper, and generally the parasite fills up by far the greater part of the abdomen of its host. Such a specimen, a species of *Hecalus* containing a larva of *P. cruciator*, is figured on Pl. VII, fig. 1.

When the larva of the *Pipunculus* quits its host, it usually

escapes at the junction of the metathorax and abdomen, either below or above, the segments of the leaf-hopper being ruptured at that point. (Pl. VII, fig. 2). In the case of a *P. xanthocnemis*, however, the larva escaped from the *Liburnia* by a roundish hole in the mid-dorsal line, at about the middle of the length of the abdomen. This hole of exit is irregular, and has the appearance of having been gnawed, but I did not notice whether the larva that emerged was different from the usual type.

After escaping from its host, the larva as a rule buries itself beneath the soil, or beneath rubbish that lies on the surface; but in some species it pupates on the leaves of the tree or bush, on which the leaf-hopper was feeding, as in a case mentioned below, and in another recorded by Ott, who bred a *Pipunculus* from a puparium found on *Ribes*.

One peculiar feature in some species of *Pipunculus* is the fact that the surface of the abdomen often bears a number of depressions, frequently variable and of irregular form. Some species, such as *P. beneficiens*, appear to always have these on one or more of the segments and they are not due to post-mortem changes, as one might suppose without the examination of freshly caught specimens, but occur in every individual, at least of the male sex, though so variable in number and form. Indeed as a general rule they appear to be more commonly found, or are more developed, in the males than the females, and sometimes may even be said to produce a distortion of the body. Whether it is to some such examples that Verrall refers, when he says that he suspects the flies are themselves subject to parasites I do not know, but it is certain that the irregularities of surface mentioned above are not due to this cause, since they are found in every example of some common species, though only occasionally in others. *Pipunculus*, however, is subject to the attack of a Chalcidid parasite of the family Encyrtidae, of which I bred a species from the puparium of *P. cinerascens*, but whether the subterranean species are likewise attacked it may be very hard to prove, unless the parasite stings the larva of the *Pipunculus*, while still within the leaf-hopper. This I suspect is not the case, or we should probably have bred some of the Chalcids from the numerous species of *Pipunculus* that we reared from the larvae. The puparium of *P. cinerascens* being freely exposed on the surface of the leaves, would naturally be liable to be attacked, and is probably stung at that time. At least it is noteworthy that the one species with exposed pupa-

rium, and the only one of which puparia were collected, yielded a parasite, while the 15 species bred from larvae, but of which no puparia were collected, since all are subterranean, yielded no parasite.

I have begun these introductory remarks by saying that the Pipunculidae are small and obscure flies. I may conclude them by saying that this in no wise detracts from the interest awakened by their peculiarities of structure and habits. The enormous eyes, the almost unique mobility of the head, which is balanced on an acute point, and which reminds one of the similar mobility of the head in the keen-eyed dragon flies, leads one to suppose that vision plays a much more important part in seeking out the prey than do the other senses, while in those other parasites of leaf-hoppers, the Dryinidae, it is obviously by other senses than vision that their prey is chiefly hunted. One may further notice the large laminate pulvilli and slender elongate claws of the feet, (which remind one of these parts in some of the parasitic Conopidae), and especially the recurved, hard and strong sting of the females, which is always exserted.

LARVA AND PUPARIUM OF *PIPUNCULUS*.

The larva of *Pipunculus* is an acephalous maggot, pointed in front and elongate when extended, but capable of great contraction, by which means and by rolling movements it is able to make sufficient progression to enable it to find a suitable spot for pupation. The cuticle in the two species examined is corrugated or transversely furrowed, so that the true segmentation is with difficulty made out. The larva is amphipneustic, the anterior stigmata being small but distinct; the posterior spiracular area dark-coloured and very distinct, the spiracles or stigmatic scars being placed anteriorly and closely approximated, and the processes or tubercles, made conspicuous by their pale colour, situated at the sides. The mouth is a simple opening at the anterior extremity and without definitely chitinized parts, but internally by dissection a pair of more or less triangular and pointed, dark, chitinized pieces may be obtained. It is possible that these are sometimes extruded, but it is not the case with any of the preserved specimens I have examined. The anterior stigmata are placed a little behind the mouth opening. Larvae of about one-third the size of full-grown individuals do not differ materially from the latter, but only in size and shape, be-

ing frequently much more contracted or even almost globular. (For. fig. of larva, see Pl. VII, fig. 10, 10a, 10b).

The puparium is formed by the hardening of the larval cuticle, which becomes black, brown, or red in colour. In some species its surface has a dense and regular coriaceous, granular, or rugulose sculpture, most conspicuous in the case of *P. cinerascens*. In some puparia there is no difficulty in distinguishing the anterior stigmata of the larva, though they are extremely minute, but in others I fail to see them after the closest examination. Further back, however, on the dorsum there can be seen on each side a fine and minute process, apparently part of the puparium, in reality not so, but connected with the delicate cuticle of the enclosed pupa and merely perforating the puparium. When the fly emerges it frequently happens that one or other of these processes is dragged back through the hole in the puparium, but remains attached to the empty pellicle of the pupa. (Pl. VII, fig. 6).

The dark posterior stigmatic area is in many species deeply depressed, in others hardly at all, and bears one or more small tubercles on either side, in fact it bears much similarity to the same part in the larva. When the fly bursts from the puparium, the latter appears to be always ruptured along the same lines, in all the species we have examined, viz: along the front and hind margin of the dorsal segment, which bears the anterior processes, and along the hind margin of the ventral segment corresponding with this.

In the case of one species of *Pipunculus*, however, although the fly itself (*P. cinerascens*) is not very remarkable, the larval habits are unlike those of any of the other species, which infest arboreal leaf-hoppers, since this larva does not fall to the ground, and pupate beneath the soil, but forms its puparium in the open on the surface of living leaves. This puparium is very different from the subterranean ones, for instead of the minute anterior processes, are a pair of relatively enormous blunt ones, on the tip of each of which is a fine spine-like process. It is not quite clear to me whether the whole blunt process represents the minute one of subterranean species, and really belongs to the pupa, and not to the puparium; or whether the small apical spine-like piece alone represents these. Posteriorly the stigmatic area is large and deep, and instead of one or two minute tubercles on each side, there are three, the upper one being very large and conspicuous, the lowest one well separated from the upper two.

(For figures of puparia see Pl. VII, fig. 3, 4, 5, 5a, 5b, 6, 7, 8 and 9).

CLASSIFICATION.

Verrall divides the British species of *Pipunculus*, which are fair representatives of the European forms, into five groups. Three of these have a pigmented stigma and are divided as follows:

I. Abdomen quite dull, not even the margins shining, femora without any ciliation or pubescence behind.

II. Abdomen partly shining; femora ciliate or pubescent at least behind the middle pair; thorax and scutellum with dense but short pubescence.

III. Thorax and scutellum practically bare, as well as the femora; the abdomen considerably shining.

The other groups are without a pigmented stigma and are separated thus:

IV. Small or discal cross-vein far before the middle of the discal cell, eyes frequently not quite touching on the frons in the male.

V. Small cross-vein placed at or about the middle of the discal cell.

Both the Australian and Hawaiian species known to me divide into stigmated and non-stigmated sections, but the further division into groups on the characters used by Verrall is not very satisfactory, if indeed possible, with the species here considered. In the following table I have therefore used other characters for the groups.

Wings with a pigmented stigma.
- Stigma not bounded by a cross-vein at the base.
  - Third antennal joint sharply pointed at the tip, usually acuminately produced.
    - Basal abdominal segment with some black bristles on each side..I
    - Basal abdominal segment with no trace of such bristles, and if pubescent, then the hairs similar to the general clothing II
  - Third antennal joint rounded at tip, or at least not acute, and never acuminately produced.................III
- Stigma bounded by a distinct cross-vein at the base......IV

Wings without a pigmented stigma.

Small or discal cross-vein far before the middle of the discal cell V

Small cross-vein at or near the middle of the discal cell..VI

One species in group VI is known in which the basal segment is entirely without lateral bristles; group IV is represented by a solitary minute species (though possibly the pair described are two, and not the sexes of one, species); while Group I contains several species in which the stigma is greatly lengthened, as compared with the fourth costal segment, somewhat resembling *Chalarus* and *Verrallia* in this respect; and some of these have the basal antennal joints rather more than usually bristly, though less so than in the latter genus. In other respects they are like ordinary *Pipunculus*. The Hawaiian species that are here described as new, belong to Group I; the double row of short spinules on the femora beneath are unusually well developed in these, as also are the marginal bristles of the scutellum and those on the basal abdominal segment; the bristles or fringe of hairs on the middle femora posteriorly are long and distinct in some males, but much less developed, and represented by soft hairs in such females, as are known.

LIST OF SPECIES OF *PIPUNCULUS* HERE DESCRIBED.

A. Australian species.

*1 *P. cruciator*, sp. nov.
*2 *P. eucalypti*, sp. nov.
*3 *P. erinys*, sp. nov.
*4 *P. hylaeus*, sp. nov.
5 *P. fallax*, sp. nov.
6 *P. dolichostigmus*, sp. nov.
7 *P. lamellifer*, sp. nov.
*8 *P. comitans*, sp. nov.
9 *P. agamus*, sp. nov.
*10 *P. cinerascens*, sp. nov.
*11 *P. beneficiens*, sp. nov.
*12 *P. helluo*, sp. nov.
*13 *P. Koebelei*, sp. nov.
*14 *P. monas*, sp. nov.
*15 *P. picrodes*, sp. nov.
*16 *P. anthracias*, sp. nov.
17 *P. crypsichalcus*, sp. nov.
18 *P. microdes*, sp. nov.

19 *P. homocophanes*, sp. nov.
*20 *P. xanthocnemis*, sp. nov.
21 *P. heterostigmus*, sp. nov.
22 *P. leimonias*, sp. nov.
23 *P. epichalcus*, sp. nov.
*24 *P. synadelphus*, sp. nov.
*25 *P. pseudophanes*, sp. nov.
26 *P. nyctias*, sp. nov.
B. Hawaiian species.
*27 *P. juvator*, sp. nov.
28 *P. oahuensis*, sp. nov.
29 *P. terryi*, sp. nov.
30 *P. swezeyi*, sp. nov.
31 *P. hawaiiensis*, sp. nov.
All species marked with an asterisk have been bred.

SYNOPSIS OF SPECIES.

In this table 1-9 deal with individuals of both sexes; after the latter number the table becomes double, 11-41 dealing with males only, 43-60 with the females.

A. Australian species.

1 (10) Wings without a pigmented stigma.
2 (9) Small cross-vein at or near the middle of the upper side of discal cell.
3 (8) Basal abdominal segment with a short line of black bristles laterally.
4 (5) Abdomen shining, deep-black, with a distinct clothing of shortish black hairs conspicuous at the sides of the segments (female unknown)....... *leimonias*.
5 (4) Abdomen more or less greenish-black or metallic, and with at most, excessively short, inconspicuous hairs.
6 (7) Larger, abdomen of male with the fifth segment without evident grey tomentum, and without short black hairs, tarsi black or piceous above; female, tarsi dark above .... *epichalcus*.
7 (6) Smaller, abdomen of male with the fifth segment more or less covered with grey tomentum, and having very short but distinct suberect hairs, tarsi more or less yellow (a little variable); female tarsi always for the most part yellow............ *synadelphus*.

8 (3) Basal abdominal segment without black bristles laterally. (Abdomen dull metallic green or at least submetallic, tarsi apparently variable, either black or dark above or yellowish.).........*pseudophanes.*

9 (2) Small cross-vein far before the middle of the upper side of the discal cell (Abdomen shining, blue-black) .... *nyctias.*

10 (1) Wings with a pigmented stigma.

11 (42) Males.

12 (13) Stigma enclosed by a cross-vein at the base........ ....*heterostigmus.*

13 (12) Stigma not enclosed at base.

14 (15) Legs, except coxae and the apical joint of tarsi, yellow, unicolorous or nearly so........*xanthocnemis.*

15 (14) Legs more or less black or dark, at least on the femora.

16 (37) Antennae with the third joint always acutely pointed at apex, usually acuminately produced.

17 (26) Wings with the third and fourth costal segments subequal, or with the fourth never much shorter than third, sometimes the fourth is the longer.

18 (21) Basal abdominal segment at the sides with a short line of distinct black bristles, which are obviously different from any other hairs on the abdomen.

19 (20) Thorax and abdomen with fuscous tomentum; hypopygium above with a deep narrow channel on the right side. ....*cruciator.*

20 (19) Thorax and abdomen mostly black or blackish, the latter with whitish lateral tomentose spots; hypopygium on the right side at the tip with a more or less ovate dull area of peculiar texture....*eucalypti.*

21 (18) Basal abdominal segment without any special bristles at the sides; if hairy, then the hairs are similar to the general clothing.

22 (23) Whole body with pale erect soft hairs, which are long and conspicuous.................*eutrichodes.*

23 (22) Body not so clothed; hairs, where present, short and inconspicuous.

24 (25) Scutellum with a marginal fringe of fine, but quite distinct hairs; abdomen for the most part blackish on the dorsum, the surface not concealed under dense tomentum. ....*beneficiens.*

25 (24) Scutellum with a few excessively short hairs on margin, which are hardly visible; abdomen with dense fuscous tomentum on the dorsum over a large part of the surface.

25a (25b) Posterior tibiae dark except at extreme base; abdomen with the second and following segments black at the base, and with rather indistinct pale apical bands, narrowed or interrupted at the middle. *monas.*

25b (25a) Posterior tibiae entirely pale or partly infuscate; abdomen with dark fuscous tomentum, not banded above.

25c (25d) Posterior tibiae almost uniformly yellowish . . *koebelei.*

25d (25c) Posterior tibiae more or less infuscate in parts . . *helluo.*

26 (17) Wings with the third costal segment much longer than the fourth, sometimes twice as long.

27 (28) Whole body nearly uniformly covered with cinereous tomentum. . . . . *cinerascens.*

28 (27) Body not so clothed; more or less variegated with black and grey or whitish tomentum.

29 (30) Tarsal joints black above . . . . *hylaeus.*

30 (29) Tarsal joints pale, except the apical joint.

31 (34) Larger and robust species (length over 4 mm.) apical margin of scutellum fringed with some longish and very distinct hairs.

32 (33) Hypopygium with a thin outstanding rounded lamella . . . . *fallax.*

33 (32) Hypopygium with an elongate, dull area marked out, but no strong lamella . . . . *dolichostigmus.*

34 (31) Smaller species (length under 4 mm.) apical margin of the scutellum with only a few very short fine hairs, easily overlooked.

35 (36) Hypopygium with a thin lamella strongly outstanding . . . . *lamellifer.*

36 (35) Hypopygium with an elongate channel or impression, but without a strong lemella . . . . *comitans.*

37 (16) Antennae with the third joint not sharply pointed at apex, nor acuminately produced.

38 (39) Abdomen except towards the base entirely shining, somewhat aeneous, and not variegated with tomentum . . . . *crypsiohalcus.*

39 (38) Abdomen more or less variegated with pale and dark bands or spots.

40 (41) Antennae with pale third joint; basal abdominal segment entirely black above, or almost so...*microdes.*

41 (40) Antennae with the third joint dark; basal abdominal segment with a pale apical band of tomentum...*homoeophanes.*

42 (11) Females.

43 (44) Stigma closed at base by a transverse vein...*heterostigmus.*

44 (43) Stigma not so closed at base.

45 (58) Antennae with the third joint more or less produced acutely at the apex, often strongly acuminate.

46 (53) Basal abdominal segment with a line of black bristles on either side, distinct from hairs of the general surface, if such be present.

47 (48) Tarsi black or dark above..................*erinys.*

48 (47) Tarsi except apical joint pale.

49 (52) Face between ocelli and antennae almost entirely hidden by a dense covering of tomentum.

50 (51) Almost the whole body evenly covered with cinereous tomentum, ovipositor straight or nearly so.......................................*cinerasceus*

51 (50) Thorax and a large part of abdomen with fuscous tomentum; ovipositor distinctly curved from base to apex. ....*cruciator.*

52 (49) Face between the ocelli and antennae bare and shining, except close to the antennae.........*agamus.*

53 (46) Basal segment of abdomen without a lateral line of distinct black bristles.

54 (55) Whole body with a conspicuous clothing of fine, erect, pale and rather long hairs.......*eutrichodes.*

55 (54) Body not so clothed.

56 (57) Abdomen black, more or less shining and sparsely tomentose. .... *beneficiens.*

57 (56) Abdomen covered with dark fuscous tomentum with grey lateral spots.

57a (57b) Second abdominal segment with an entire basal band of whitish-grey tomentum...............*picrodes.*

57b (57a) Second segment without such a band.

57c (57d) Posterior tibiae almost uniform yellowish, not infuscate in middle; ovipositor longer.......*koebelei*

57d (57c) Posterior tibiae more or less infuscate about the middle; ovipositor shorter....................*helluo.*

58 (45) Antennae with the third joint more or less rounded and not acutely produced at the apex.
59 (60) Legs except the coxae clear yellow....*xanthocnemis*.
60 (59) Legs largely black, or dark brown........*anthracias*.

B. Hawaiian species.

1 (2) Wings without a pigmented stigma.. *rotundipennis, Grimsh.*
2 (1) Wings with a pigmented stigma.
3 (6) Posterior tibiae with some specially developed bristles on the median dilatation outwardly.
4 (5) Legs except the coxae entirely pale, yellow..*hawaiiensis*.
5 (4) Legs largely black on the femora, and the tarsi also dark .... *oahuensis*.
6 (3) Posterior tibiae without special bristles on the median dilatation outwardly.
7 (8) Legs except coxae entirely pale, yellow.....*swezeyi*.
8 (7) Legs with the femora at least more or less black or fuscous.
9 (12) Hind legs with a more or less distinct median dark band on the tibiae.
10 (11) Third joint of antennae, and tarsi pale.......................................*molokaiensis, Grimsh.*
11 (10) Third joint of antennae, and tarsi dark.......................................*nigrotarsatus, Grimsh.*
12 (9) Hind legs without a median dark band on tibiae, sometimes darkened towards base and apex, but the middle always pale.
13 (14) Abdomen of male for the most part deep-black or blue-black, femora of the female black above for the most part, the base and apex for a short distance yellow. ....*juvator*.
14 (13) Abdomen of male for the most part blackish-fuscous, with a slight aeneous tint in some aspects; femora of the female to a large extent yellow, somewhat infuscate, but not black, on the apical half...*terryi*.

DESCRIPTION OF SPECIES.

In the descriptions of the species not much stress need be placed on the exact colours of the pale tomentose spots or bands, whether whitish, greyish, or slightly flavescent as they are hard to discriminate and not constant The same may be said of the measurements, which vary much in some species and are subject to error owing to contraction or curvature of the body after death.

A. Australian Species.

1. *P. cruciator*, sp. nov.

Head black; between the ocelli and antennae, and the face below these, almost entirely covered with white tomentum in the female, as is the whole front and face in the male; posteriorly with fuscous tomentum, becoming grey at the sides, and finely ciliated. Antennae with the two basal joints black or piceous; the third yellow, sometimes sordid or obscured, in the male pointed at the tip, in the female more strongly and acuminately produced. In the latter sex even the basal antennal joints are sometimes yellowish, though possibly only in immature examples.

Thorax above covered with fuscous tomentum, greyer on the metathorax and pleura; scutellum with a sparse marginal fringe of very short fine hairs; halteres yellow, blackish or fuscous at base. Wings subinfuscate, stigma yellowish brown, third and fourth costal segments subequal. Legs with the coxae, femora, the apical joint of tarsi, and tips of claws, black or dark; the rest of tarsi, the trochanters, the apex and usually the base of femora, as well as the tibiae yellow; the latter often more or less darkened or brownish in parts. The hairs on the legs are extremely short, and placed in rows.

Abdomen covered with fuscous tomentum, more or less grey or yellowish grey on the apical margins of the segments, or at least on the sides of some of the apical segments in the male; in the female the abdomen usually has a distinct pattern, the grey tomentum on the third, fourth and fifth segments, forming a wedge-shaped lateral mark, leaving a large triangular fuscous area on the disc, the second segment being grey with a fuscous discal spot. Basal segment with a line of 3-5 con-

spicuous black bristles on each side. Hypopygium of male deeply channeled on the right side, and shortly and finely pilose; at the tip with a large fovea or impression. Ovipositor distinctly curved from base to tip. Length 3.25-5 mm. (Pl. V, fig. 126, VII, fig. 1, 6, 7.)

HAB. Cairns district, on the coast and in the mountains; bred several times from a species of *Hecalus*, (Koebele's specimens are numbered 2268) and also by Mr. Koebele from a very different Jassid nymph (No. 2275).

2. *P. eucalypti*, sp. nov.

Male: Head in front, and face, with glistening white tomentum; behind the eyes in the middle with dark, at the sides with whitish. Antennae dark, black or blackish; third joint pitchy, pointed at the apex, but hardly produced.

Thorax dull black, with thin fuscous tomentum, in front laterally, the metanotum, and the pleura, with white or greyish white; the scutellum with fine marginal hairs, which are quite easily seen, being considerably longer than the few that are on the disc. Wings nearly clear, neuration dark, stigma brown, third and fourth costal segments subequal, posterior cross-vein very oblique, its upper extremity about opposite the apex of the second longitudinal; halteres largely pale, dark basally. Legs black or pitchy, knee-joints pale, tarsi above yellow or yellowish brown, but sometimes appearing dark from the many short, black hairs; tibiae more or less brownish or yellowish.

Abdomen black, with some fuscous tomentum, and with whitish lateral tomentose spots, as well as an apical band on the basal segment; the latter with the usual lateral row of bristles; all the segments with shortish hairs, very distinctly outstanding from the side of each; hypopygium with a subovate or subtriangular apical area, very dull, and of different texture from that of the rest of the segment. Length 4 mm. (Pl. V, fig. 4.)

HAB. Bundaberg; one male bred from the nymph of a Jassid on *Eucalyptus* by Mr. Koebele (2297); by a slip of the pen recorded in his notes (under this number) as being bred from a Fulgorid.

3. *P. erinys*, sp. nov.

Female; head black, bare for about half the distance from the ocelli to the antenna, the face and front being covered with

white, glistening tomentum; posteriorly with whitish tomentum at the sides, in the middle more fuscous. Antennae black or dark, the third joint acuminate, blackish or pitchy, evidently, though not very strongly, produced at the apex.

Thorax dull black, sparsely covered with fuscous tomentum, in front laterally and on the pleura with whitish grey tomentum, with which the metathorax is also covered; scutellum with a few very fine marginal hairs, not at all conspicuous; halteres blackish. Wings with the neuration, except at the base, where it is paler, black or nearly so; stigma distinct but rather pale, about as long as the fourth costal segment; small or discal cross-vein opposite apex of auxiliary; second longitudinal vein terminating nearly opposite, or a little beyond, the upper extremity of the posterior cross-vein. Legs black, the knee-joints, pulvilli and claws (except apically) pale, the tarsi black or at least dark above, but paler beneath, the hairs of the legs and feet black.

Abdomen more or less transversely wrinkled, black, with wedge-shaped marks of whitish grey tomentum on the third, fourth and fifth segments; first and second with whitish grey tomentum, the disc of the latter being black, sixth nearly entirely covered; basal segment with a few black tristles on each side. Ovipositor straight. Length 3.75 mm.

HAB. Bundaberg, Queensland; bred from a common Jassid on *Melaleuca*.

4. *P. hylaeus*, sp. nov.

Male: Head in front and face with dense white tomentum; posteriorly behind the eyes with dark in the middle and whitish at the sides. Antennae black, the third joint pitchy black, acute at the tip, but hardly produced.

Thorax dull black, with sparse fuscous tomentum, in front at the sides and on the pleura with whitish, as also on the metanotum; scutellum with a few very short and fine, hardly perceptible, marginal hairs; halteres sordid fuscous. Wings hyaline, hardly smoky, neuration dark, stigma pale, brownish-yellow, third costal segment about twice as long as the fourth, upper extremity of posterior cross-vein nearly opposite (or a little before) the termination of second longitudinal. Legs black, base of tibiae yellowish, the hind tibiae with some hairs outwardly about the middle, which, though short, are longer than the general clothing.

Abdomen black, transversely wrinkled, the apical margins of the segments paler and more shining in some aspects, and with whitish tomentum, especially laterally; basal segment with distinct lateral bristles, second with a few short hairs; hypopygium with sparse and very short hairs, more or less impressed at the base towards the right side, and also with a terminal impression. Length 3.5-4 mm. (Pl. V, fig. 7, Pl. VII, fig. 8.)

HAB. Bundaberg, Queensland; bred from two species of Jassids, Mr. Koebele's specimen, numbered 2321, being reared from a very different species of leaf-hopper from one which yielded me the same fly.

5. *P. dolichostigmus*, sp. nov.

Male; front and face with silvery grey or whitish tomentum, as also the head posteriorly. Antennae pitchy black, the third joint paler, but sordid, distinctly produced acuminately at the apex.

Thorax black, with fuscous tomentum, at the sides in front and on the pleura more grey, the metanotum covered with whitish; scutellum with sparse hairs, those on the hind margin twice as long as those on the disc; halteres sordidly pale, black at the base. Wings with the neuration blackish, paler at base, stigma pale brown, about twice as long as the fourth costal segment, small cross-vein about opposite the apex of the auxiliary vein, posterior cross-vein very oblique, its upper extremity about opposite the apex of the second longitudinal vein. Legs with the coxae black, trochanters (more or less), apex and base of femora, tibiae for the most part, tarsi except the apical joint, yellow; posterior tibiae about the middle at the thickening with two or three longish hairs outwardly.

Abdomen with very short suberect hairs; the second, third, fourth and fifth segments deep black at base, with greyish tomentum apically, as on the whole of the basal segment, which has a transverse row of 8 or 10 black bristles at the sides; the second segment at the sides with some weak black hairs; hairs on the abdomen mostly pale. Hypopygium with a narrow elongate area, the surface of which is dull and of peculiar texture. Length 4.75 mm.

HAB. Bundaberg, Queensland. One example captured.

6. *P. fallax*, sp. nov.

In all respects like the preceding, but with the hypopygium bearing a prominent thin lamella, the edge of which, seen in profile, is rounded. Length 4.75 mm.

HAB. Bundaberg, Queensland. One male captured.

7. *P. lamellifer*, sp. nov.

Male; head in front and face with glistening whitish tomentum, as also posteriorly at the sides, between which it is more fuscous. Antennae with the third joint distinctly and sharply acuminately produced, and piceous or obscurely pale.

Thorax covered with fuscous tomentum, at the extreme front generally with some more or less evident pale tomentose spots, the pleura with greyish, the metanotum covered with whitish tomentum, the scutellum with some very inconspicuous and short hairs. Wings fuscous tinted, third costal segment considerably longer than the fourth, the small cross-vein rather beyond the apex of the auxiliary. Legs black or pitchy, knee-joints and tarsi yellowish, the apical joints of the latter dark, tibiae for the most part brownish above.

Abdomen with blackish tomentum forming great subtriangular discal markings, the rest of the surface being occupied by grey or whitish tomentose lateral spots; basal segment with whitish or grey tomentose band, and with a distinct lateral line of black bristles on each side; hypopygium with a large, outstanding, thin lamella. Length 3 mm. (Pl. VI, fig. 2.)

HAB. Cairns district; coast and mountains.

8. *P. comitans*, sp. nov.

Like the preceding in almost all respects, but the hypopygium has an elongate cleft or depression, instead of the thin outstanding lamella.

HAB. Cains district, in the same localities as the preceding. One specimen (2283) was bred by Mr. Koebele from the male of a Jassid living on grass, and I obtained one from a female Jassid of probably the same species.

9. *P. agamus*, sp. nov.

Female; head black, shining and bare in front of the ocelli,

the face and front being covered with glistening white tomentum, antennae with the third joint strongly and very sharply, acuminately produced, its colour piceous or obscurely pale.

Mesonotum covered with fuscous tomentum, at the sides in front (more or less) and the pleura and metanotum with whitish grey; scutellum with some very short and indistinct hairs; halteres pale, dark at base. Wings nearly clear, third costal segment generally distinctly longer than the fourth, but a little variable; small cross-vein rather beyond the apex of the auxiliary; posterior cross-vein very oblique, its upper extremity beyond the apex of the second longitudinal; stigma pale brown. Legs dark, the knees and tarsi (except the apical joint) yellow, the tibiae largely dark or brown.

Abdomen with dark fuscous tomentum, and lateral spots of greyish white, the basal segment with a lateral line of distinct black bristles, and with a band of whitish tomentum; ovipositor straight, longer and slenderer than in most Australian species. Length 2.5-3 mm.

HAB. Cairns district, with the two preceding. Without doubt it is the female sex of one of these, but as it differs in important characters from both, and it is impossible to associate it specially with either, I have temporarily given it another name.

10. *P. cinerascens*, sp. nov.

Head in front, and the face covered with dense glistening whitish tomentum; posteriorly at the sides with whitish, in the middle with darker grey. In the female the dense tomentum of the face extends back to the ocelli. Third joint of the antennae yellow, and very strongly acuminately produced at the apex.

Thorax with slate-coloured tomentum; in front laterally, the pleura and the metanotum with whitish; the scutellum with some very fine, short and inconspicuous hairs; halteres yellow, dark at base. Wings extremely clear, neuration dark, stigma pale brown, third costal segment much longer than the fourth, upper extremity of the posterior cross-vein about opposite the apex of the second longitudinal. Legs black, femora and tibiae with pale tomentum, knee-joints and tarsi (except the apical joint) yellow, tibiae largely brownish or darkened.

Abdomen nearly uniformly covered with whitish slate-coloured tomentum, the basal segment with a line on each side of several longish and distinct black bristles; hypopygium of male

with a large apical impression on the right side; ovipositor of the female nearly straight and not very long. Length 3 mm. (Pl. V, fig. 2, VII, fig. 4 and 9.)

HAB. Bundaberg, Queensland; bred freely from puparia on the leaves of *Melaleuca*.

11. *P. beneficiens*, sp. nov.

Head with the front and face covered with glistening white tomentum, in the female black, bare and shining in front of the ocelli, posteriorly with greyish white tomentum on each side and fuscous between. Antennae black or piceous, the third joint acuminate and strongly produced at the apex, variable in colour usually more or less yellowish, but sometimes wholly dark or wholly yellow, in the female often of the latter colour, but even in this sex it is sometimes dark.

Thorax with thin fuscous tomentum, in front laterally and the pleura more or less grey, the metanotum with denser grey or whitish tomentum; the scutellum with extremely fine marginal hairs, the surface more or less shining, in some aspects at least; halteres pale, dark at base. Legs black, tip of femora, the tibiae and tarsi (except the apical joint) yellow, the tibiae more or less black or infuscate in part. Wings in the male distinctly smoky, clearer in the female, neuration blackish, paler towards base of wing, stigma distinct, obscure brown, about as long as the fourth costal segment, small cross-vein opposite the apex of the auxiliary, and at about the basal third of the upper side of the discal cell.

Abdomen black, often somewhat shining in the male, and clothed with short sparse hairs, at the sides with greyish white tomentum, which in fresh specimens also forms a band on the basal segment; some or most of the segments generally with depressions of varying form and often irregular; hypopygium large, with a transverse basal impression and with a shining hairless lobe on the right side, which extends beneath to the genital armature itself. In the female the abdomen is generally like that of the male, black and more or less shining, with white tomentum laterally, and more or less evidently on the dorsum of the first or of the two basal segments, the surface usually with few or no depressions, the ovipositor straight; basal segment in both sexes with no trace of a line of bristles laterally. Length 2.25-3.25 mm. (Pl. V, fig. 3; VI, fig. 3.)

HAB. Common throughout Queensland; bred from a Jassid, 2291, by Mr. Koebele, and by myself from very different species.

12. *P. helluo*, sp. nov.

Head with the front and face covered with glittering white, or whitish, tomentum, behind the eyes with grey at the sides, and between with dark fuscous. Antennae black or piceous, third joint acuminately produced at the apex and apparently always dark in colour. Mesothorax with rather dense fuscous tomentum; at the sides in front and the pleura with grey or whitish; the metanotum densely covered with whitish tomentum; scutellum with a few hairs, so short and fine, as to be seen with difficulty; halteres yellowish-brown or testaceous, dark at base. Wings somewhat smoky, clearer in the female, the neuration black or very dark brown, paler at the base, stigma obscure brown, subequal to the fourth costal segment, or rather shorter, small cross-vein opposite the apex of the auxiliary. Legs black or pitchy, the apex of femora, the tibiae (which, however, are more or less dark or infuscate in parts) the tarsi (except the apical joint) yellow or yellowish.

Abdomen with dense and even, dark fuscous tomentum, and greyish wedge-shaped lateral tomentose spots, the basal segment more or less evidently grey-banded, and with no line of bristles on each side; the dorsum often with more or less evident, and often irregular, impressions on one or more segments, the surface not noticeably pilose; hypopygium of the male large, with sparse and very short, inconspicuous hairs, somewhat shining in some aspects, impressed (often irregularly) at the base, and with a distinct lateral lobe on the right side, which is not covered with tomentum. Ovipositor of female straight or nearly so. Length 2.5-3.5 mm.

HAB. Bundaberg, Queensland, bred from nymphs of Siphanta sp. on several occasions. Mr. Koebele bred this species from another genus of Poecilopterine Fulgorids, found on *Ricinocarpus* at Sydney, N. S. W. (No. 2362); his number for Bundaberg was 2326.

13. *P. Koebelei*, sp. nov.

This species agrees in almost every way with *P. helluo*, but I have no doubt it is distinct in spite of the extraordinary re-

semblance between the two, since in the male the small hairless lobe on the right-side of the great hypopygium in this species is subtomentose, the hind tibiae are almost uniform yellowish in both sexes, not brownish or infuscate in the middle, and the ovipositor of the female is very decidedly longer. Antennae dark, but the third joint more or less pale in the female, at least apically. Length 2.75-3.5 mm. (Pl. VII, fig. 5.)

HAB. Sydney, New South Wales, Nos. 2373 and 2395 of Koebele, who bred it from a Jassid found on the sandhills.

14. *P. monas,* sp. nov.

Male; head in front, and face with white tomentum; posteriorly with fuscous, more greyish laterally; antennae black, third joint acuminately produced, dark, but with paler tip.

Mesonotum covered with fuscous tomentum, and with two whitish spots in front, the pleura and metanotum whitish tomentose; scutellum with excessively minute, hardly visible hairs; wings slightly smoky, stigma as long as the fourth costal segment, small or discal cross-vein about opposite the termination of the auxiliary, and far before the middle of the discal cell; legs black, extreme tip of femora and the base of tibiae yellowish, front and middle tarsi black or dark above, the posterior apparently more or less pale.

Abdomen dull, basal segment black, with a distinct apical pale tomentose band, and with no trace of bristles laterally, the following segments black basally, but with pale apical bands, widest at the sides, and either narrowed or interrupted in the middle. Hypopygium large, sparsely tomentose, and with the surface shining, and with a very few excessively short (almost invisible) hairs. Length 3 mm.

HAB. Bundaberg, Queensland; one male bred by Mr. Koebele (2333) from a common Jassid. Very distinct in its group by the dark tibiae and abdominal pattern.

15. *P. picrodes,* sp. nov.

Female: general appearance and structure as in the two preceding species, but of larger size, the lateral grey tomentose spots of the abdomen large and distinct, though hardly visible on the dorsum, basal segment with the grey tomentose apical band narrower than in the female of *P. Koebelei,* and the second

segment with a distinct and entire basal band, which occupies half the segment or more and is narrowed at the middle. Posterior tibiae yellow, hardly darkened in the middle, except beneath. Third joint of the antennae clear yellow, not at all infuscate even basally. Ovipositor moderate, probably relatively longer than in *P. helluo*, shorter than in *P. Koebelei.* Length 3.5 mm.

HAB. Sydney, N. S. W.; bred from a Jassid on *Leptospermum* (Koebele No. 2351).

16. *P. anthracias*, sp. nov.

Female. Head in front and the face black, with little or no tomentum, the face extremely narrow, the inner margins of the eyes nearly touching, much closer together below than above the antennae; the latter dark, blackish or dark fuscous, the third joint in side view rounded at the apex, not acuminate; behind the eyes the head has fuscous tomentum, greyish at the sides.

Thorax thinly covered with fuscous tomentum, and somewhat shining; at the sides in front and on the pleura with whitish, the metanotum densely covered with the same; scutellum with very sparse, fine, inconspicuous hairs. Wings distinctly smoky, neuration blackish, paler at base, stigma brown, subequal to, or a little shorter than, the fourth costal segment, the posterior cross-vein before the apex of the second longitudinal. Legs black or piceous, knees pale, tarsi sometimes yellow, but generally more or less obscure, or fuscous, above; tibiae for the most part brownish or fuscous.

Abdomen with the two first and basal part of the third segment densely covered with whitish tomentum, the rest shining black, with sparse short hairs; basal segment on each side with a short row of a few distinct black bristles; ovipositor straight. Length 2-2.5 mm. (Pl. V, fig. 9.)

HAB. Kuranda, and Cairns, Queensland; one was bred by Mr. Koebele from (?) *Thamnotettix* (No. 2339), the others were captured specimens.

17. *P. crypsichalcus*, sp. nov.

Male: face below the antennae excessively narrow, black and hardly tomentose, the front with whitish tomentum, as also the

head posteriorly at the sides. Antennae with the third joint yellow, not sharply pointed at the apex.

Thorax shining, blackish aeneous, with some whitish tomentum at the sides in front and on the pleura, more densely tomentose on the metanotum; scutellum with extremely fine, short marginal hairs; halteres pale in the middle, dark at base, and more or less so on the apical portion. Wings distinctly clouded, stigma dark brown, not reaching back to the apex of the auxiliary vein, third costal segment as long as the fourth, small cross-vein well beyond the apex of the auxiliary, the upper extremity of the posterior cross-vein a little before the apex of the first longitudinal. Legs black or dark; the apex of femora, the tibiae and tarsi (except the apical joint) yellow or pale, the tibiae more or less darkened with brown or fuscous.

Abdomen shining, aeneous, more piceous or brownish towards the base, blacker apically, the basal segment and the second (more or less) clothed with grey tomentum; hypopygium twisted to the right, impressed at the base, and with a definite area or impression at the tip, within which the surface appears to be paler in colour. Length 2.5 mm.

HAB. Kuranda, near Cairns, N. Queensland.

18. *P. microdes*, sp. nov.

Male: head with the eye-margins touching for about half the distance from the ocelli to the antennae, the front and face black, with little or no pale tomentum, space between the eyes beneath the antennae extremely narrow; head posteriorly with fuscous tomentum, becoming whitish at the sides. Antennae with the third joint pale, not at all acute at the tip.

Thorax somewhat shining, and covered, but not densely, with fuscous tomentum the metathorax densely clothed with grey; scutellum with a few short and extremely fine marginal hairs. Halteres pale, dark at base. Wings somewhat smoky, third costal segment as long as, or rather longer than, the fourth; posterior cross-vein hardly oblique, its upper extremity before the termination of the second longitudinal. Legs with the trochanters, base and apex of femora, tibiae and tarsi nearly entirely, yellow.

Abdomen deep black on the three basal segments, the second and third with lateral spots of grey tomentum, two following segments in some aspects smooth and shining, somewhat metal-

lic, but seen, in some views, to bear a thin covering of pale tomentum; basal segment at the sides apparently with only one or two bristles, which are not easily seen. Hypopygium impressed at the base and bent to the right, the tip with a large distinct impression. Length 2 mm. (Pl. V, fig. 5.)

HAB. Kuranda, near Cairns, N. Queensland.

19. *P homoeophanes*, sp. nov.

Male: front of head and face black, the surface not concealed by pale tomentum, but nearly bare; posteriorly the head is dark, but greyish tomentose at the sides. Antennae with the third joint dark, not acutely pointed at the apex.

Thorax with fuscous tomentum, more greyish at the sides in front, and on the pleura, denser and grey on the metanotum; scutellum at the most with a few excessively short fine hairs, very indistinct; halteres pale, dark at base. Wings subinfuscate, neuration black, stigma brown, third and fourth costal segments not differing much in length, upper extremity of posterior cross-vein before the apex of the second longitudinal. Legs pitchy, knee joints and tarsi paler, brownish or brownish yellow.

Abdomen deep black, with pale lateral spots, which on some segments unite to form apical bands; fifth segment shining in some aspects, as probably are the other parts occupied by pale spots, if the tomentum be removed; basal segment on each side with about three black, longish bristles; hypopygium bent to the right and the tip with a large impression. Length 2.5 mm.

HAB. Kuranda, near Cairns, N. Queensland.

20 *P. xanthocnemis*, sp. nov.

Head in front and the face with white or greyish white tomentum; in the female for half the distance from the ocelli to the antennae black, bare and shining; posteriorly fuscous in the middle, grey laterally. Antennae with the third joint yellow, not sharply pointed at the tip, nor at all produced.

Thorax somewhat shining, nigroaeneous, beneath a thin covering of fuscous tomentum, metanotum much more densely clothed with greyish white; scutellum with extremely short and fine marginal hairs; halteres pale, dark at base. Wings hardly clouded, third costal segment in the male distinctly longer than the fourth, but in the female the difference in length is less, and

in one specimen the fourth is fully as long as the third; posterior cross-vein oblique, its upper extremity about opposite the apex of the first longitudinal. Legs, except the coxae, nearly uniformly clear yellow.

Abdomen, black, bare and shining in the male, and more or less aeneous, the first segment with more or less distinct tomentum; in the female more tomentose, especially the first two segments, and sometimes hardly aeneous; basal segment with a short lateral line of a few black bristles. Length 2-3.25 mm. (Pl. V, fig. 8.)

HAB. Cairns district and Bundaberg; bred from a *Liburnia*.

21. *P. heterostigmus*, sp. nov.

Head with the front and face in the male with whitish tomentum; in the female the tomentum between the ocelli and antennae is divided by a shining and bare, black carina; face beneath the antennae extremely narrow; head posteriorly with fuscous tomentum becoming whitish towards the sides. Antennae with the apical joint somewhat pointed at the tip, but not sharp, nor produced, yellow in the female, sordid or pitchy in the male.

Thorax with fuscous tomentum in the male, greyish or whitish fuscous in the female; on the metathorax with dense white covering. Halteres yellow, dark at the base. Wings with dark neuration, stigma yellowish brown, and enclosed on the basal side by a strong cross-vein third costal segment considerably longer than the fourth, posterior cross-vein before the apex of the second longitudinal. Legs for the most part yellowish in the female, but the femora are largely darkened above and at the sides; in the male the legs are altogether darker, the trochanters, knee-joints and tarsi mostly yellowish, the tibiae for some part more brown.

Abdomen sparingly tomentose, and without pattern; on the basal segments more or less pallid, brownish or yellowish, but darker posteriorly the apex being blackish; basal segment with two or three bristles on each side. Length about 2 mm. (Pl. V, fig. 10.)

HAB. Redlynch and Kuranda near Cairns. A single male and female in each case, taken from boughs of trees, so that it probably attacks arboreal leaf-hoppers.

22. *P. synadelphus*, sp. nov.

Black, with always more or less of an aeneous tinge, and generally very distinct dull brassy. Front of head and face with dense white tomentum; in the female the space between the eyes in front of the ocelli is rather shining and conspicuously impressed, and bears very little tomentum compared with the front. Antennae with the third joint acuminate, and more or less pale apically.

Thorax with not very dense fuscous tomentum, and with a pale spot on each side in front; the metanotum with dense whitish grey tomentum; scutellum with at most a few hardly visible hairs; halteres yellow, black at base. Wings clear, third costal segment very short, not stigmated; small cross-vein beyond the apex of the first longitudinal, at or rather beyond the middle of the upper side of discal cell; posterior cross-vein very oblique, its upper extremity beyond the apex of the second longitudinal. Legs black, knees and tarsi pale.

Abdomen with a band of tomentum on the basal segment, and with a line of distinct black bristles on each side; elsewhere sparsely tomentose, and with very short black hairs, which are quite easily seen; hypopygium of male somewhat tomentose and with sparse and excessively short hairs, which are less conspicuous than those on the preceding segment; ovipositor of female straight and slender. Length 25-3 mm. (Pl. VI, fig. 4.)

HAB. Bundaberg, Queensland, common; also at Cairns, and Mr. Koebele bred one specimen from a Jassid taken on grass at Childers (2319).

23. *P. epichalcus*, sp. nov.

Aeneous, the abdomen in the female more or less copper-coloured; front and face with greyish or white tomentum, which in the female extends back to the ocelli; posteriorly the head at the sides has whitish tomentum; antennae dark with the third joint acuminate, and at the most only sordidly pale.

Thorax with a pale spot on each side in front, and with whitish (or subflavescent) tomentum on the pleura and sides of the metanotum, elsewhere hardly tomentose; scutellum with a few scarcely visible hairs; halteres pale, dark at base. Wings hyaline, hardly infuscate, third costal segment very short, not stigmated, small cross-vein near the middle of the upper side of the discal cell and beyond the apex of the first longitudinal; pos-

terior cross-vein oblique, its upper extremity beyond the termination of the second longitudinal. Legs black, tip of femora and base of tibiae yellow, tarsi dark above, black or piceous.

Abdomen of the male sometimes more or less shining, generally duller in the female, basal segment with a band of white tomentum, and with a few black bristles on each side, elsewhere nearly bare. Hypopygium of the male with a great impression at the tip; ovipositor of the female very slightly curved. Length 3.25-3.5 mm.

HAB. Cairns, Queensland; two or three specimens captured, but not bred.

24. *P. pseudophanes*, sp. nov.

In almost every respect like the preceding, but less brightly aeneous, and at once distinguished by the fact that the basal abdominal segment is without the line of black bristles on each side. The legs in this species appear to vary in colour, the tarsi being generally black or brown above, but in one specimen they are yellow. Length 3.25-3.75 mm.

HAB. Cairns, Queensland; on the coast and in the mountains; one example was bred from the same Jassid (a species of *Hecalus*) as *P. cruciator*.

25. *P. leimonias*, sp. nov.

Male; front of head, and face with white tomentum, as also the head posteriorly at the sides; third joint of antennae strongly acuminate, blackish or pitchy.

Thorax very thinly tomentose, with a pale spot on each side in front; the metanotum more densely covered with whitish tomentum, especially at the sides; halteres whitish, black on the basal half; mesonotum and scutellum with short and fine but quite noticeable erect hairs. Wings nearly clear, third costal segment very short, and not stigmated; small cross-vein near the middle of the upper side of discal cell, and beyond the apex of the first longitudinal vein; upper extremity of posterior cross-vein beyond the termination of the second longitudinal. Legs black, knee joints yellow, tarsi black or pitchy above.

Abdomen blue-black, sparsely but quite conspicuously clothed with short black hairs; basal segment without a band of pale tomentum, but with the bristles well developed on each side; hypopygium with greyish-fuscous tomentum, impressed or channeled. Length 3 mm.

HAB. Brisbane, Queensland.

26. *P. nyctias*, sp. nov.

Deep black, or blue-black; front, face, and head at the sides posteriorly with dense white tomentum; antennae with pale third joint, acuminate at apex.

Thorax more or less shining, and thinly clothed with fuscous tomentum, that on the metanotum white, and dense at the sides; scutellum with scarcely visible hairs; a pale spot on either side of the thorax in front. Wings subinfuscate, but darker in some examples than in others, third costal segment very short, and not stigmated; fourth costal segment also short, but longer than the third; small cross-vein about opposite the extremity of the first longitudinal, and considerably before the middle of the upper side of the discal cell; upper extremity of posterior cross-vein far beyond the apex of the second longitudinal. Legs black, apex of femora, tarsi, and tibiae yellow, the latter more or less dark in the middle, trochanters sometimes more or less pale.

Abdomen blue-black, shining; the basal segment with whitish or grey tomentum, and a line of black bristles on each side; elsewhere the abdomen with sparse and very short dark hairs, most noticeable towards the apex; hypopygium of male with a large cleft or impression, ovipositor relatively long. Length 2.5-2.75 mm. (Pl. VI, fig. 5.)

HAB. Cairns and Bundaberg, Queensland.

B. Hawaiian Species.

27. *P. juvator*, sp. nov.

Black, the face and front with whitish, or grey tomentum, more obscure and fuscous in some examples, head shining and bare in front of the ocelli in the female; antennae very variable in colour, entirely black, or with the third joint, which is acuminately produced, piceous, sordid yellow or even entirely clear yellow rarely of the latter colour in the male, the tendency being to a paler colour in the female, in which, however, the antennae are sometimes entirely dark.

Thorax dark, more or less shining, and sparsely clothed with fuscous tomentum, the metanotum more densely with whitish or grey; the scutellum with a marginal series of distinct longish bristles; halteres pale, dark at base; wings blackish smoky in the male, clear in the female, stigma brown, small cross-vein about opposite, or a little beyond the apex of the auxiliary, and well

before the middle of the discal cell; posterior cross-vein very oblique. Legs with coxae and femora black, the latter more or less distinctly yellow at base and apex, and beneath with two rows of short spines or spinose hairs at least on the apical part; tibiae yellow, sometimes darker towards the base and on the apical portion, but yellow in the middle, the posterior pair with no specially long hairs on the dilatation; tarsi nearly always black, brown, or fuscous above in the male, sometimes black in the female but often largely yellow, as is rarely the case in the former sex.

Abdomen in the male deep black or bluish black, shining (at least apically) and bearing short black hairs; the basal segment with a band of grey tomentum, and a transverse row of long black bristles at the sides; in the female the abdomen is distinctly covered with grey tomentum, most densely on the apical portion of the first segment, and bears short and sparse, but quite evident, dark hairs. Length 3-4.75 mm. (Pl. VI, fig. 1; VII, fig. 10, 10a, 10b.)

HAB. Hawaii generally; now common in the cane-fields. This is the species referred to me in my Bulletin "The leaf-hopper of the sugar cane" as occurring at Olaa. It has also been found on Oahu by Mr. Swezey, but has not been taken in the cane-fields of this island.

28. *P. oahuensis*, sp. nov.

This appears to me to agree in nearly all important structures with the preceding, as well as in superficial appearance with certain of its varieties. In *P. oahuensis* the tarsi are dark in both sexes, the tibiae yellow and unbanded, the third antennal joint is yellow, or at least pale, in both sexes, but usually sordidly so in the male. The wings in the latter sex are quite smoky, in the female clear. The dilatation of the posterior tibiae outwardly bears some specially long black bristles, which differ from the general clothing of the legs, and this fact readily separates the species from the preceding. The ovipositor is very short and strong. Length 3.75-4.5 mm.

HAB. Mountains of Oahu.

29. *P. terryi*, sp. nov.

Front and face covered with white or whitish tomentum; third joint of antennae yellow or ferruginous, acuminate.

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DESCRIPTION OF PLATES.

Plate V.

1. *P. cruciator*, female.
2. *P. cinerascens*, antenna viewed from the side outwardly.
3. *P. beneficiens* do
4. *P. eucalypti* do
5. *P. microdes* do
6. *P. cruciator* do
7. *P. hylaeus* do
8. *P. xanthocnemis* do
9. *P. anthracias* do
10. *P. heterostigmus* do

Plate VI.

1. *P. juvator* wing
2. *P. lamellifer* do
3. *P. beneficiens* do
4. *P. synadelphus* do
5. *P. nyctias* do

Plate VII.

1. *Hecalus* sp. containing larva of *P. cruciator*.
2. do after escape of the full grown larva.
3. Common type of *Pipunculus* puparium.
4. Puparium of *P. cinerascens*.
5. Puparium of *P. Koebelei* after emergence of fly; 5a the segment bearing the dorsal stigmatic processes or "horns;" 5b one of the processes more highly magnified.
6. Puparium of *P. cruciator* the horn-bearing segment removed showing the "horns" attached to the empty pupal skin.
7. Posterior stigmatic area of *P. cruciator*.
8. do *P. hylaeus*.
9. do *P. cinerascens*.
10. Larva of *P. juvator*; 10a posterior stigmatic area of the same in dorsal aspect; 10b the same in apical view.

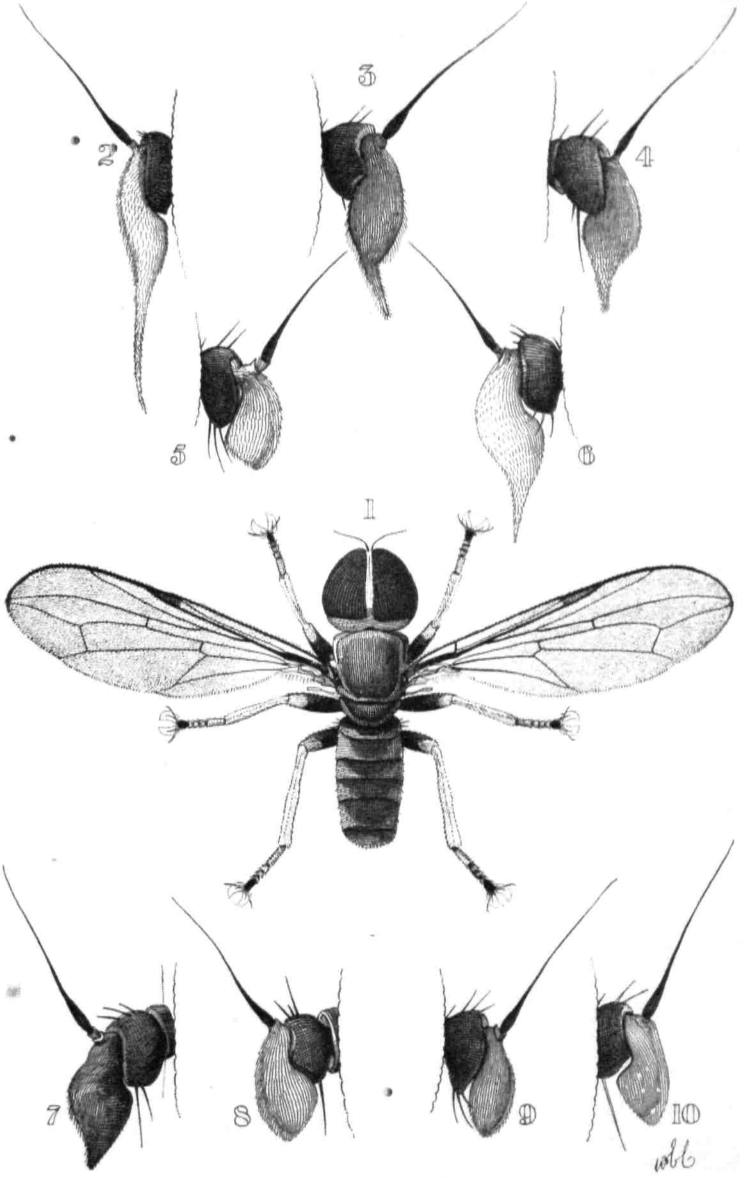

PLATE V.

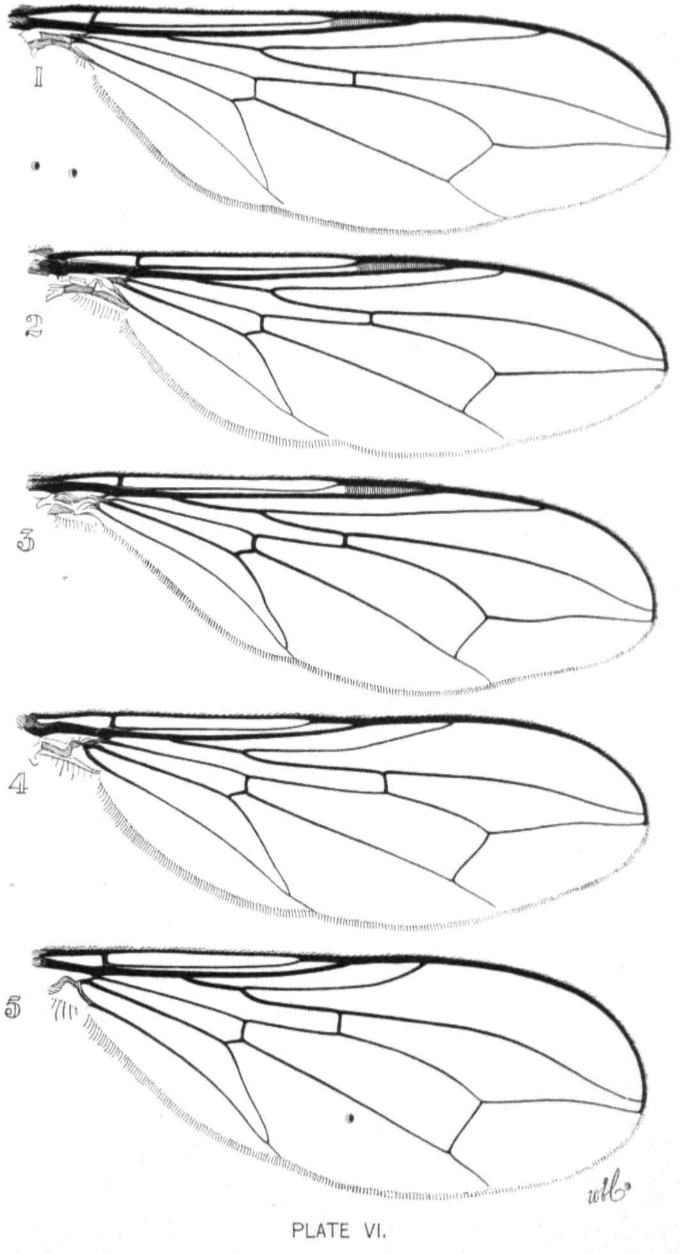

PLATE VI.

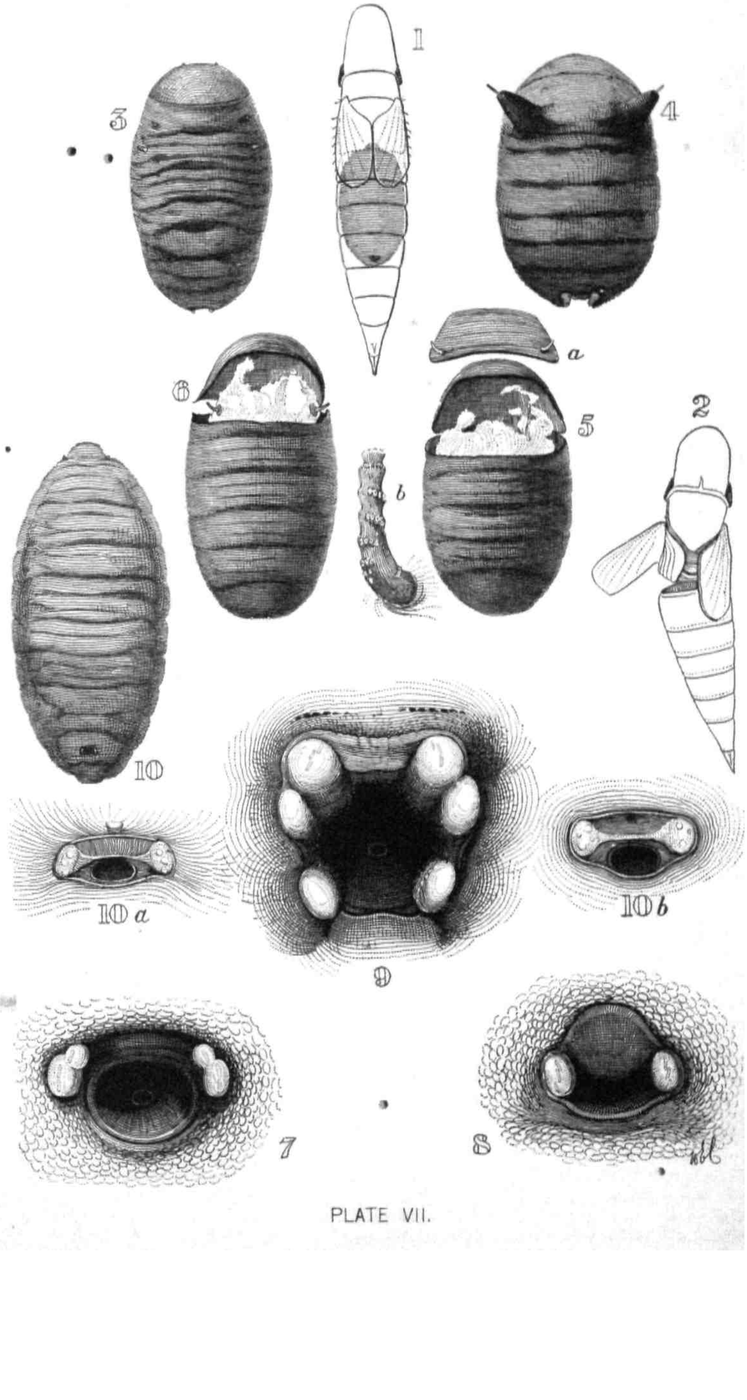

PLATE VII.